

Inhibitor Longevity and Deicer Performance Study: Second Year Scope of Work

(Federal Fiscal Year 2008)

1. Objectives of the Pooled Fund Study

The objectives of the proposed research are to evaluate the longevity of corrosion inhibitors in storage and on the road and their cost-effectiveness, and to establish a reliable measure to quantify the performance of anti-icing and deicing products.

Specifically, mostly through the combination of laboratory and field investigations, this Transportation Pooled-Fund study aims to answer the following important questions:

- 1) What is the longevity of the corrosion inhibitors, when in storage or on the road?
- 2) What is the duration the inhibitors remain with the deicers, when applied onto the road?
- 3) What are the effects of storage (temperature, UV intensity, exposure time, and type of deicer) on inhibitor longevity and effectiveness?
- 4) Do the inhibitors contribute to freezing point suppression or improve the effectiveness of deicers?
- 5) How does the laboratory test protocol correlate with deicer performance in the field?
- 6) What is the most effective product to use and its optimal application rate to combat ice formation, under each typical road weather scenario identified by the sponsor states?

By answering the first four questions, this research will allow the transportation agency to determine whether the inclusion of inhibitors into liquid or solid deicers is cost-effective, taking into account: the acceptable deicer corrosivity, reasonable duration of protection expected of inhibitors, and other agency-specific constraints.

The deicer products to be evaluated will be decided upon by the PNS and the Technical Advisory Committee. To promote the synergy between the research related to inhibitor longevity and deicer performance, it is suggested that these two parts or phases be conducted simultaneously.

As a starting point, the deicers that will be tested fall within the following PNS Categories (specific types will be determined by the TAC):

- PNS Category 1, Corrosion Inhibited Liquid - MgCl_2
- PNS Category 2, Corrosion Inhibited Liquid - CaCl_2
- PNS Category 4, Corrosion Inhibited Solid - NaCl

2. Project Schedule and Work Plan for the First Year

Table 2-1 is a high-level schedule for the project, where the duration of each task is given in months. The schedule has been established for a three-year period, assuming a start date of October 1, 2007, with year two beginning on October 1, 2008.

As shown in Table 2-1, the work plan for the second year includes the following tasks (see the technical details in the full proposal attached):

Task 0. Project Management

-including project kickoff meeting

Task 1. Experimental Design and Planning

- to be 100% complete by November 2008.

Task 2. Laboratory Investigation

Task 2.1. Methods to Rapidly Quantify Chloride and Inhibitor Concentrations

- to be 100% complete by April 2009

Task 2.2. Method to Rapidly Quantify Corrosivity of Deicers

- 100% complete by June 2008

Task 2.3. Method to Rapidly Quantify Deicer Performance

-100% complete by June 2008

Task 2.4. Inhibitor Longevity under Laboratory Conditions

- to be 100% complete by April 2009

Task 3. Field Investigation

Task 3.1. Inhibitor Longevity: Storage Monitoring and Cost-Benefit Analysis

- to have a PNS category 4 product or similar product selected by the Steering Committee and TAC and in place by January 2009. Continue storage monitoring through the end of the second year and generate useful data.

Task 3.2. Deicer Performance: Field Application

Three storms will be created to test inhibitor longevity in the field and performance the winter of 2008-2009. Equipment to be used for application of deicers will be scaled down from a snow plow to a towed trailer with liquid and solid application abilities. In addition, methods to sample deicer residues from pavements (with frost, black-ice, snowy, icy conditions) will be established and practiced in the field prior to creating a storm event.

Table 2-1: Proposed project timeline by month

		Calendar Year / Month																																			
		2007			2008												2009												2010								
Tasks	Milestones	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
Task 0. Project Management																																					
Project kickoff	Oct-07	<div><div></div></div>																																			
Task 1. Experiment Design and Planning																																					
Task 2. Laboratory Investigation																																					
Task 2.1. Methods to Rapidly Quantify Chloride and Inhibitor Concentrations																																					
Task 2.2. Method to Rapidly Quantify Corrosivity of Deicers																																					
Task 2.3. Method to Rapidly Quantify Deicer Performance																																					
Task 2.4. Inhibitor Longevity under Laboratory Conditions																																					
Task 3. Field Investigation																																					
Task 3.1. Inhibitor Longevity: Storage Monitoring and Cost-Benefit Analysis																																					
Task 3.2. Deicer Performance: Field Application																																					
Task 4. Project Reporting																																					
Quarterly progress reports	End of each quarter																																				
Draft final report	Jul-10																																				
Final report w/ executive summary	Sep-10																																				

Laboratory testing will be continued in the 2008-2009 winter season at the MSU Civil Engineering Department Sub-zero Research Facility. The dilution factor of the deicers and inhibitors will be tested as well as the potential percent recovery of material off asphalt pavement surfaces. This testing will utilize asphalt pavement slabs with materials provided by MDT but made by MSU.

Task 4. Project Reporting

As one activity under this task, the research team will provide quarterly progress reports to the TAC through the WSDOT project manager. These progress reports will cover recent activities associated with Tasks 1 through 3. The summary will describe, for each task, activities completed in the most recent three-month period, activities foreseen for the next three-month period, and the estimated percentage of work complete. The progress reports will also include a brief, executive summary-level narrative of preliminary findings.

As necessary, the progress reports will describe any issues or obstacles that have affected project progress or the direction of the research. However, the research team believes that it is better to address these issues as they arise; therefore, regular communication between the team and the Steering Committee (described under Task 0) will be used to more quickly resolve any such issues.

The research team will submit the progress reports electronically as Microsoft WordTM documents. If the Steering Committee and/or TAC members are interested, the research team may present the progress report as a Microsoft PowerPointTM presentation in a teleconference.

3. Budget and Level of Effort

The estimated budget and detailed efforts for the second year of the Pooled Fund Study are listed in Table 3-1, totaling \$194,251 and 3,062 person-hours, respectively. The Transportation Pooled Fund will provide \$194,251 of funding since the Western Transportation Institute has contributed \$100,000 of match funding to date, with the remaining \$50,000 of match saved for year three. The personnel will include Dr. Shi (PI), Ms. Fay (Co-PI), Mr. Doug Cross, Mrs. Marijean Peterson (WTI-CSIL manager), Ms. Akin (Coordinator with Lewistown Test-bed Project), WTI administrative support, laboratory technician, and undergraduate students. Other items include: Travel (between Bozeman and the Lewistown Test-bed; trips to report progress and present results); Operations/Communications; Contracted Testing Services (for UV-Vis, DSC, and other chemical analysis); Lewistown Facility Usage (for the use of portable road weather sensors, test tracks, storage sites and tanks, power and water); and Corrosion Lab Testing and Other Supplies (for PNS/NACE tests, electrochemical tests, ice-melting tests, etc.). Indirect costs are charged at 42.5 percent of direct costs; this rate is the standard used by Montana State University on research contracts.

Table 3-1: Proposed second year project budget by cost category

	Role	Federal Fiscal Year 2008	Hours	Cost
		Oct 08- Sept. 09		
Dr. Xianming Shi, PE	PI	164	164	\$8,589
Ms. Laura Fay	Co-PI	350	350	\$11,620
Dan Williams	Liasion/ Advisor	164	164	\$7,721
Laboratory technician	Chemist	492	492	\$13,068
Doug Cross	Research	492	492	\$16,728
Marijean Peterson	Lab Manager	328	328	\$7,944
Ms. Michelle Akin	Coordntr w/ Lewistown	40	40	\$1,322
Mr. Eli Cuelho	PE/ Research	12	12	\$572
Undergraduate Student	Research	984	984	\$12,989
Business Manager	Support	12	12	\$534
Administrative Support	Support	24	24	\$631
Labor (hours)		3,062	3,062	
Labor (\$)		\$81,717		\$81,717
Travel		\$8,100		\$8,100
Operations/Communications		\$500		\$500
Infrastructure costs		\$3,000		\$3,000
Contracted Testing Services		\$3,500		\$3,500
Lewistown Facility Usage		\$30,000		\$30,000
Corrosion Lab Testing and Other Supplies		\$9,500		\$9,500
Indirect (42.5%)		\$57,935		\$57,935
Total Cost (\$)		\$194,251		\$194,251